

CLAIMS

1. A method of detecting a plugged sensor port in a system containing a fluid being monitored comprising steps of:

5       establishing a range beyond which a fluid variable is expected to vary within a predetermined time interval;

          measuring the fluid variable to provide a measured fluid variable; and

          indicating the plugged sensor port in response to the measured fluid variable remaining within the range for the predetermined time interval.

10

2. The method as claimed in claim 1, wherein the establishing step is at least selectively performed in response to the measured fluid variable being outside the range.

3. The method as claimed in claim 1, wherein the establishing step comprises  
15       determining an upper threshold value and a lower threshold value for the fluid variable.

4. The method as claimed in claim 3, wherein the determining step comprises calculating the upper threshold value and the lower threshold value as a percentage of one of an expected operating value, and the measured fluid variable.

20

5. The method as claimed in claim 1, further comprising selecting the predetermined time interval based on characteristics of the process being monitored.

6. The method as claimed in claim 1, wherein the step of indicating the plugged sensor  
25       port includes indicating the plugged sensor port in response to the measured fluid variable remaining within the range for at least two consecutive predetermined time intervals.

7. A method of detecting a plugged port connection in a fluid-containing apparatus  
30       involved in a process, the method comprising steps of:

          measuring a fluid variable through the port to provide a measured fluid variable;

10027351.12004

determining a range, based on the measured fluid variable, beyond which the fluid variable is expected to vary in a predetermined time interval;

re-measuring the fluid variable; and

indicating that the port connection is plugged responsive to the fluid variable remaining within the range for the predetermined time interval.

8. The method as claimed in claim 7, wherein the steps of measuring the fluid variable and determining the range are performed responsive to the fluid variable being outside the range.

9. The method as claimed in claim 7, wherein the step of determining the range comprises:

determining an upper threshold of the fluid variable; and

determining a lower threshold of the fluid variable.

10. The method as claimed in claim 7, wherein the step of determining the range comprises determining a minimum amount by which the fluid variable is expected to vary above and below a nominal operating value, over a selected time interval.

11. The method as claimed in claim 7, wherein the indicating step is performed in response to the fluid variable remaining within the range for at least two consecutive predetermined time intervals.

12. The method as claimed in claim 7, further comprising a step of performing a corrective action to clear the plugged port connection in response to the indication that the port is plugged.

13. The method as claimed in claim 7, further comprising a step of providing information regarding a condition of the port to a remote location.

14. The method as claimed in claim 7, further comprising steps of:  
receiving an input from a user; and

providing a control signal responsive to the input to program at least one of the range and the time interval.

15. The method as claimed in claim 7, further comprising a step of displaying  
5 information regarding the port connection for access by a user.

16. A device that detects a plugged sensor port in a system containing a fluid being monitored, the device comprising:

a sensor mechanism that senses a fluid variable through the sensor port;

10 a controller that establishes a range beyond which the fluid variable is expected to vary within a predetermined time interval, determines whether the fluid variable is within the range, and indicates a plugged sensor port in response to the fluid variable remaining within the range for the predetermined time interval.

15 17. The device as claimed in claim 16, wherein the controller establishes the predetermined time interval based on characteristics of the fluid variable.

18. The device as claimed in claim 16, wherein the controller comprises:

a timer; and

20 a comparator that compares the fluid variable to an upper threshold value of the range and a lower threshold value of the range to determine whether the fluid variable is within the range.

19. The device as claimed in claim 16, further comprising a mechanism that clears the  
25 plugged sensor port, responsive to a signal from the controller indicating a plugged sensor port.

20. The device as claimed in claim 19, wherein the mechanism that clears the plugged sensor port includes a vibrator that vibrates in response to an actuating signal, thereby  
30 clearing the plugged port.

21. The device as claimed in claim 20, wherein the vibrator includes a piezoelectric sensor/vibrator.

22. The device as claimed in claim 19, wherein the mechanism that clears the plugged  
5 sensor port includes a mechanical device, movable within the port to clear the port.

23. A device for detecting a plugged sensor port connection in a fluid-containing apparatus monitoring a process, the device comprising:

a sensor that measures a fluid variable through the port;

10 a first means for determining a range beyond which the fluid variable is expected to vary during a predetermined time interval;

a second means, coupled to the sensor, for determining whether the fluid variable is within the range; and

15 a third means for providing an indication of a plugged port responsive to the fluid variable remaining within the range for the predetermined time interval.

24. The device as claimed in claim 23, wherein the first means determines the range based on a measured value of the fluid variable.

20 25. The device as claimed in claim 24, wherein the first means determines the range based on a current measured value of the fluid variable, responsive to the current measured value being outside the range.

26. The device as claimed in claim 23, wherein the first means determines the range by  
25 establishing an upper threshold and a lower threshold for the range of the fluid variable.

27. The device as claimed in claim 23, wherein the predetermined time interval is programmable based on characteristics of the process being monitored.

30 28. The device as claimed in claim 23, further comprising a means for clearing the plugged port connection.

29. The device as claimed in claim 28, wherein the means for clearing the plugged port connection comprises a vibrator that vibrates in response to an actuating signal, thereby clearing the plugged port.

5 30. The device as claimed in claim 28, wherein the means for clearing the plugged port connection comprises a heater that heats the fluid in response to the indication of a plugged port.

10 31. The device as claimed in claim 28, wherein the means for clearing the plugged port connection comprises a movable mechanical device that moves in response to an actuation signal, thereby clearing the plugged port.

15 32. The device as claimed in claim 28, wherein the movable mechanical device comprises at least one of: a pinch valve mechanism, a rotatable vane, a rotatable auger and a butterfly valve.

20 33. The device as claimed in claim 28, wherein the means for clearing the plugged port connection comprises a vessel containing a solvent, the vessel being connected to the sensor port via a valve mechanism, and wherein the valve mechanism is actuated to allow the solvent to enter the sensor port in response to the indication of the plugged port.

25 34. The device as claimed in claim 23, further comprising an I/O port coupled to the third means and adapted to provide to a remote location an indication that the port connection is plugged.

30 35. The device as claimed in claim 23, wherein at least one of the range and the time interval is programmable, and wherein the device further comprises a user interface adapted to receive an input from a user to set one of the range and the time interval.

36. The device as claimed in claim 35, wherein the user interface includes an output for providing information to the user.

100273641122001

37. The device as claimed in claim 35, wherein the output comprises a display that provides information regarding the port connection for access by an operator.

5 38. The device as claimed in claim 37, wherein the information comprises an indication that the port connection is plugged.

39. A method for detecting and clearing a plugged sensor port in a system containing a fluid being monitored via the sensor port, the method comprising steps of:

10       sensing a fluid variable through the port to provide a measured fluid variable;  
      detecting a plugged sensor port based on the measured fluid variable remaining within a predetermined range for a predetermined period of time; and  
      actuating a clearing mechanism to clear the plugged sensor port responsive to the plugged sensor port being detected.

15 40. A computer readable medium encoded with at least one program for execution on at least one processor, the program performing a method for detecting a plugged sensor port connection in a system relating to a process being monitored, the method comprising steps of:

20       establishing an operating value of a fluid variable;  
      determining a range beyond which the fluid variable is expected to vary within a predetermined time interval;  
      measuring the fluid variable;  
      determining whether the fluid variable is within the range; and  
25       indicating a plugged port condition in response to the fluid variable remaining within the range for the predetermined time interval.

41. A device that detects a fault condition relating to a process being monitored, the device comprising:

30       a sensor that measures a fluid variable; and  
      a controller that establishes a range beyond which the fluid variable is expected to vary within a predetermined time interval, determines whether the fluid variable is within

10027364-122001

the range, and indicates the fault condition in response to the fluid variable remaining within the range for the predetermined time interval.

42. The device as claimed in claim 41, wherein the controller establishes the  
5 predetermined time interval based on characteristics of the process being monitored.

43. The device as claimed in claim 41, wherein the controller comprises:  
a timer; and

a comparator that compares the fluid variable with an upper threshold value and a  
10 lower threshold value of the range to determine whether the fluid variable is within the range.

10027364.122001